WISDOM IS COMMON SENSE TO AN UNCOMMON DEGREE.

Vol. VIII. No. 1
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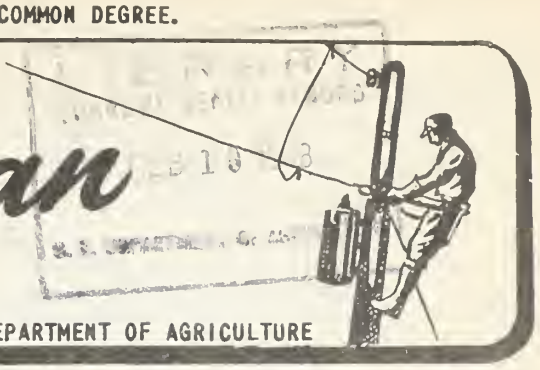
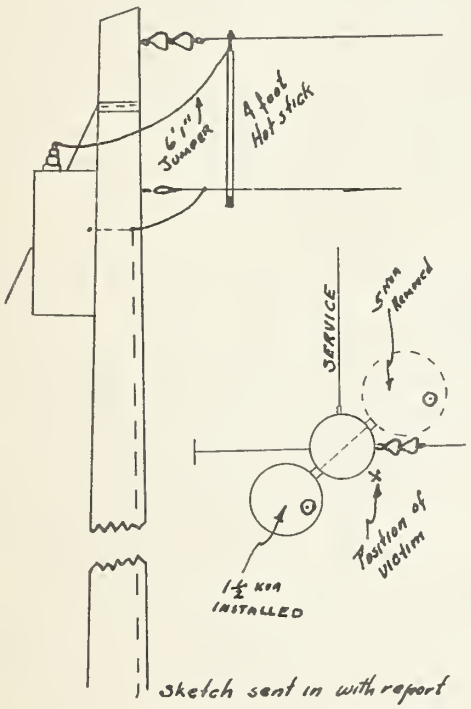
the Lineman

RURAL ELECTRIFICATION ADMINISTRATION - U.S. DEPARTMENT OF AGRICULTURE



Transformer Change-Out Results In Fatality



Sketch sent in with report

LINEMAN DIES DAY AFTER POLE-TOP ACCIDENT

A lineman and his helper, a second class lineman, were changing out a 5 KVA transformer and replacing it with a 1 1/2 KVA transformer. The 1 1/2 was to be located in a new position. The transformer installation was on an a-5 pole with 2 wire service drops.

The change-out and relocation had been completed except for installing the jumper from the transformer bushing to the phase wire. The helper sent up the jumper and a 4-foot hot stick. Then he busied himself loading the truck.

The lineman placed the jumper in the bushing terminal of the transformer. In doing so he apparently got it crossways of the groove rather than down into the groove. He then took his 4-foot hot stick and attached the live line clamp to the phase wire. Having energized the transformer, he now proceeded to do a workmanlike job of straightening out the jumper. The jumper was 6 feet 1 inch long which was at least eighteen inches longer than necessary. In addition to this the 4-foot hot stick required him to be much too high on the pole. Improper seating of the jumper in the primary bushing terminal evidently caused the wire to be held insecurely. For, during his attempt to straighten out the jumper, the end came out of the terminal and fell on the victim's left shoulder about 4 inches from his neck. He fell backward in his belt. As he did so the jumper dragged across his chest and burned for a distance of about six inches. The victim's knees buckled and his hooks cut out causing him to continue his backward fall. His head struck the pole hard. He slid down the pole, retarded by his safety belt, to a point about 8 feet above the ground. Here his belt caught and he hung in a partly sitting position. His helper climbed up to him and lowered him with his hand line. The injured man regained consciousness immediately and was rushed to the hospital soon after. He died the next day

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"We Resolve. . ."

The Resolutions Committee of the 1947 REA Job Training and Safety Instructors submits the following resolutions for consideration by the Conference. These resolutions were unanimously adopted:

Resolved that all grounds and the neutral conductor be removed from any pole on which live-line work is being done with live-line tools, when possible.

Resolved that oil circuit breaker installations be such that hot-line clamps be installed on both load and line side.

Resolved that hot-line clamps be installed only on line sides of single or repeating sectionalizing and protective equipment.

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THE LINEMAN
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for Employees of REA Financed Systems
Ralph A. C. Hill, Editor
Frank H. Le Master, Associate Editor

Knowledge is Gained From Practical Experience

-- Editorial --

E. H. Stovall, Job Training and Safety Supervisor for Mississippi, led the discussion on REA specifications at the recent Supervisor's Conference. At the beginning of the discussion Mr. Stovall said in part, ... 'I am of the opinion that REA specifications as a whole are the best in the electric light business for serving rural territories. I have been associated with different companies, both private and public, but I have been impressed most by the special effort REA is making to get the man who climbs the poles to offer suggestions. This is something new in the electric business and I feel that it has paid dividends. Good engineering has as much to do with preventing accidents as any other department in the electric light business. I feel that the practical man and the engineer need each other to make the business better and safer.'

No industry can progress without research. Experimentation and study will be just as necessary tomorrow as they are today. Likewise progress is hampered unless the lessons learned from the every-day operation and maintenance of the business are used. The field is the laboratory. Continuation of the close cooperation between the practical man and the engineer will result in obtaining much valuable information. Experience is often a costly teacher. It is none-the-less a good teacher.

REA sincerely desires to provide the best possible specifications for the construction of lines to bring electricity into rural America. Many lines built to serve the rural needs in the late thirties are now obsolete due to the phenomenal demands which the farmsteads are making by using a large varity of appliances.

Some lines originally designed to carry a lighting load and to be worked cold are now overloaded with important power and heat loads. It is often requited that these lines be worked hot. Rebuilding these lines will remedy the situation. In doing so, it is highly desirable to be familiar with the problems which confronted the men who operated and maintained these lines.

Who knows what demands the next ten years will make on our rural systems? What changes will be necessary? No one knows, of course. One sure way to meet the problems in the years ahead is close cooperation to solving the everyday problems as they arise.

"We Resolve"

Continued

Resolved that line trucks be grounded when setting poles in or near energized lines, or any time that the truck can become energized from any source.

Resolved that hot stick work be done only by qualified and trained workmen under adequate supervision.

Resolved that we continue urging the use of rubber gloves from the ground up.

Resolved that the eye-bolt supporting the primary take-off on an A5 addition to an A1 or A2 be lowered to a point 6 inches below the bottom of the pole top pin, and the neutral conductor be lowered accordingly.

Resolved that on any transformer or other assembly which does not conform with standard specifications, when work must be performed on the assembly, the assembly be rehung according to REA present specifications.

Resolved that the phase jumper be buttoned back upon itself and not used as a grounding device.

Recommend that the condition of ground resistance be determined at the time of ground rod installation according to REA specifications and codes governing this operation.

Resolved that paralleled transformers be plainly identified in some manner.

Resolved that the Engineering Division furnish all Job Training and Safety Instructors with an up-to-date file of Engineering Memoranda, and keep it up to date.

Resolved that the Management Division furnish all Job Training and Safety Instructors with an up-to-date file of all Management Memoranda pertaining to job training and safety, and keep it up to date.

Resolved that when hot-line taps be removed from energized lines, hot line sticks be removed from pole.

Resolved that hold-off tags be placed on all sectionalizing devices where lines are de-energized.

Resolved to hold district conferences for the purpose of developing and teaching instructional material to the REA Job Training and Safety Instructors and to encourage college credit for teacher-training courses.

Resolved that the U. S. Office of Education be used as a 'clearing house' for instruction materials and mailing lists:

a. Of Trade and Industrial Education Supervisors available to States having REA programs.
b. Of Job Training and Safety Instructors available to persons participating in the annual training conference.

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SUMMARY OF ELECTRIC SHOCK FACTS

Part Three - Conclusion

Amperage and not voltage is the lethal factor in electric shock. Voltage combined with skin and internal body resistance determines how much amperage will flow thru the body. Dry skin has a high resistance. Wet or moist skin has a low resistance. As soon as the skin is punctured, larger currents will flow because skin resistance has been eliminated. Since sweat glands are located in the palm of the hand -- who is able to judge whether there is not enough moisture on the skin surface to reduce skin resistance materially?

One hundred twenty (120 - 240) volt potentials are sufficiently high to cause fatal electric shock when skin is wet or moist at the point of contact.

It takes but a very few one thousandths of an ampere to cause ventricular fibrillation. This is a condition of the heart which results from over-stimulation. When it occurs the heart ceases to act as a pump and circulation of the blood stops. A successful means of treating this condition has never been developed. Death usually results soon after ventricular fibrillation starts.

It is our opinion that electrical shocks received under certain conditions from 120-240 volt circuits are more liable to cause ventricular fibrillation than shocks received from the higher voltages.

During 1947, 34 linemen were rendered unconscious by electrical shock. 31 of these were from voltages ranging from 2300 to 7200 volts. 3 of the victims had contacted 120-240 volt circuits. Of the 31 high voltage cases 12 were revived by artificial respiration. This is a ratio of one man saved for each 2 1/2 who were not. Of the 3 low voltage cases, none were saved.

Electrical shock has many other effects on the body. Breathing may be stopped due to the effect of electrical current on the nerve centers which control breathing. Many times this condition is only temporary if no serious damage to nerves and other vital organs has been done. When breathing stops, the blood is unable to obtain oxygen as it passes thru the lungs. There are cases on record where it was necessary to apply artificial respiration for several hours before the victim's nervous system recovered sufficiently to function properly. Remember, it is important to start artificial respiration as soon as possible -- after five minutes has elapsed the chance to revive diminishes rapidly. Pole top resuscitation, when safe to use, provides the quickest possible method to get air into the victim's lungs.

High Voltage Stops Heart

High voltage electric shock causes such large currents (amps) to flow that the violent muscular reaction may clamp the heart so tightly as to stop it. The heart may resume its normal beating after contact is broken and the chest muscles relaxed. This is most likely where the contact was of short duration and the heart itself was not damaged. The massaging action resulting from artificial respiration helps the heart to resume its normal beating, if it does not start automatically. Again, elapsed time before applying artificial respiration is important. Brain and nerves are damaged beyond repair if blood containing oxygen is cut off for slightly more than 3 minutes. It is believed that enough blood can be supplied to the brain thru massaging action produced by artificial respiration to make possible any considerable extension of this critical period. This could explain why some victims who had no sign of pulse were revived.

Do not pronounce the man dead just because you fail to detect any pulse.

It could also make more understandable an actual instance in which the victim had no outside evidence of severe burns. Artificial respiration was started within six minutes on this case yet was ineffective in saving the victim.

Heavy Currents Damage or Destroy

The December issue of 'The Lineman' pointed out the heavy currents which would flow under certain conditions. Vital organs inside the body may be damaged or destroyed by the arcing and the heating effects of these heavy currents. Damage of this nature may not be apparent.

It is not uncommon for a victim of electrical shock to be revived and then die within minutes or even several days later. This can be due to damage done to the heart muscles, ruptured blood vessels causing internal bleeding in some vital area, and the type of shock which may accompany any type of serious injury. Readers who have had Red Cross First Aid know that a serious injury can cause what is known as 'shock' which can result in death. Since this type of shock can develop several hours after an injury, it must be watched for in electrical shock victims after they have been revived.

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Shock Facts

Continued

Red Cross Training Important

In addition to learning both prone pressure and pole top resuscitation methods, every one should have Red Cross First Aid training. First Aid training makes it possible to do what is necessary and at the right time. The life of the electric shock victim depends on what his fellow workmen do before the doctor comes.

This series of three articles has not been presented as a scientific or technical discussion of the aspects of electrical shock. Rather, we have tried to make it simple and understandable. In doing this we have left out many of the qualifying statements which would be required in a technical discussion. Whether the safe current value is 9 milliamperes or 15 milliamperes we feel is of little practical value to the lineman. We do feel, however, that the fact that only a few thousandths of an ampere can result in death is of utmost value to the men working on the lines. It is important to the office worker, the meter tester and even the family at home.

Anyone desiring to pursue this subject in greater detail may do so by obtaining copies of the articles from which this material was gathered.

(Source material for this series was gathered from articles by H. A. Poehler, Westinghouse Electric and Manufacturing Co., Electronics Magazine for July, 1944; John B. Lagen, M. D., Electrical West Magazine for March, 1941; and from Charles Dalziel of the University of California.)

Transformer

Continued

Examination.

Blood flowing from the ears would indicate skull fracture. A broken vertebra was also discovered. Burns were also found on right shoulder where it touched the neutral wire. There were also burns on the right hand and arm where contact was made with the pole and pole ground.

Discussion Points.

This system used 8-foot jointed hot sticks. Just prior to the accident these sticks had been re-varnished. When dry they were mismatched so that the bottom section did not fit the top section. Therefore, only a 4-foot section was available when the lineman energized the transformer. *What advantage would the position on the pole afforded by an 8-foot stick be to the lineman?*

"We Resolve"

Continued

Resolved that the Chairman of this conference write the Programs Committee Chairman of the Utilities Section, National Safety Council to include in the 1948 National Safety Congress program the subject 'Rural Electrical Line Work.'

Suggestion that Planning Committee give consideration to have stenographer take notes at our next annual meeting, to be supplemented by the speaker's draft or outline; proceedings to be reprinted so that all in attendance receive copies.

Resolved that a uniform accident report be used throughout the country with at least the following: *STATE ACCIDENT AS HAPPENED, Causes and possible remedies.*

Resolved that Job Training and Safety Instructors stress and carry to all co-op employees the importance and necessity of maintaining good public relations in each individual organization with the project area. In doing this, we must not lose sight of the importance of having the active participation and support of the local board of directors.

Resolved that we thank Mr. Hill and his staff and the Planning Committee for inviting us to this conference. Special thanks is also due to Mr. Cooper and Mr. Ross and all Trade and Industrial Educators for the training given.

Respectfully submitted; W. L. DeVaughn, N. C.; C. A. Strait, Iowa; J. C. Staff, Kan.; J. H. Couch, Tenn.; I. K. Boggs, Mo. Chairman,

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The jumper could have been eighteen inches shorter. *Could this have made any difference?*

Note the position of the original 5 KVA transformer and the position in which the 1 1/2 was installed. *Is this according to specifications?*

Is there any advantage in testing the connection of the jumper to the transformer primary bushing before the live line clamp is hooked on to the line?

Do you discuss such points as this at your safety meetings? System managers and safety and job training men all over the country send us accident reports each month. They spend a good deal of time getting details so we can report to you how the other fellow got hurt. Their time is well spent if in discussing these accidents, your men benefit by being able to avoid similar situations. Is it too much to expect that the next time one of our readers starts to use a 4-foot stick, he will remember this and drive back to town for an 8-footer? Will it cause each of you to think about position on the pole, specifications, and their relation to the job you are doing? If so, this man has not died in vain.